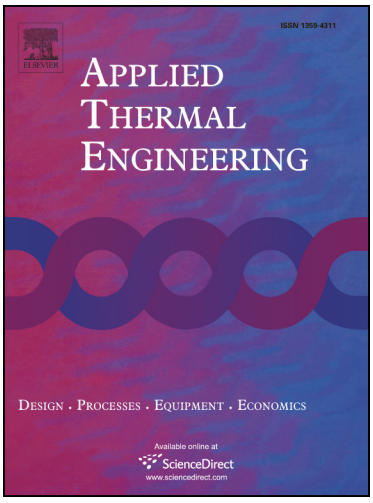

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Thermal analysis of earth-to-air heat exchanger using laboratory simulator

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Abstract

Shallow depth of ground has shown that it is able to produce potential cooling and heating throughout the year. The cooling and heating can be extracted by means of an earth-air heat exchanger (EAHE) technique, numerically and experimentally. The authors have identified that the field experiment has limitations in rapid change of input parameter, repeatability and unnecessary. Thus, this paper presents the performance of EAHE based on experimental studies using a laboratory simulator. Different input parameters have been investigated such as air inlet temperature varies from 31 to 35 °C, ground temperature (T_g) varies from 23 to 25 °C and air flow rate at 0.03 to 0.07 kg/s. The actual soil surrounding was created and 8.7 m PVC pipe was used in the simulator. Results show that the flow rate of 0.03 kg/s and T_g of 23 °C gives the highest temperature reduction with 9.62 °C or 27.5 percent relative to the inlet temperature. The highest heat transfer rate at 558.3 W was obtained at a flow rate of 0.07 kg/s and T_g of 23 °C. The experimental results also have been validated with a field test from other researchers and were found to be in close agreement.

Keywords: earth-air heat exchanger; passive cooling; heat transfer; annual outlet temperature; thermal characteristic.